

Student Information

Essential Questions:

What clues do rocks hold about ways and rates that landscapes change over time?

What changes in matter and transformations of energy control Earth's processes?

How do water velocity, streambed slope/gradient, and underlying rock type affect the shape of the stream valley?

How might the stream valley change over time?

Investigation Question:

What is the relationship between stream velocity and changes in stream elevation?

Background:

We have been studying how the Earth changes over time due to a variety of factors such as plate tectonics, rock formation, weathering and erosion. We have looked at different agents of change like water, wind, volcanism, subduction, and chemical reactions. The area we will explore is part of Brandywine Creek State Park. This area was once mountain and coastal plain that eroded over time. The area is continuing to change today. The activities in this unit will require you to make predictions, analyze data, draw conclusions, and synthesize your knowledge to draw a hypothesis of how the stream will change in the future.

Geology of Red Clay Valley, the Brandywine Creek, and Rocky Run Tributary

- ❖ Metamorphic basalt- volcanic area in the distant past
- ❖ This piedmont was created as the coastal plain was subducted under the North American plate.
- ❖ The rock changed over time due to pressure and heat deep in the lithosphere
- ❖ Metamorphic basalt erodes slowly
- ❖ Other rocks found in the area: marble, quartzite, gneiss due to sedimentary rock depositing over time.

Vocabulary:

Velocity	Latitude	Longitude	topographic map
Slope/gradient	metamorphic	sedimentary	stream valley
Streambed	elevation	subduction zone	piedmont

Activity One

1. Examine the two photographs of the moving stream.
2. List differences and similarities
3. Predict which photo shows water moving at a greater velocity. Explain why you chose that photo.

Activity Two: Field Study

Location: Rocky Run, a Brandywine River Tributary

Question: What is the relationship between stream velocity and changes in stream elevation/slope?

Hypothesis: As the elevation/slope of the stream increases the velocity of the stream increases.

Procedure: A member of the group used 5 meters of string and a fishing bobber to measure the amount of time it took the bobber to travel 5 meter in the center of the stream.

Start area: 0.5 miles upstream from the mouth of the tributary

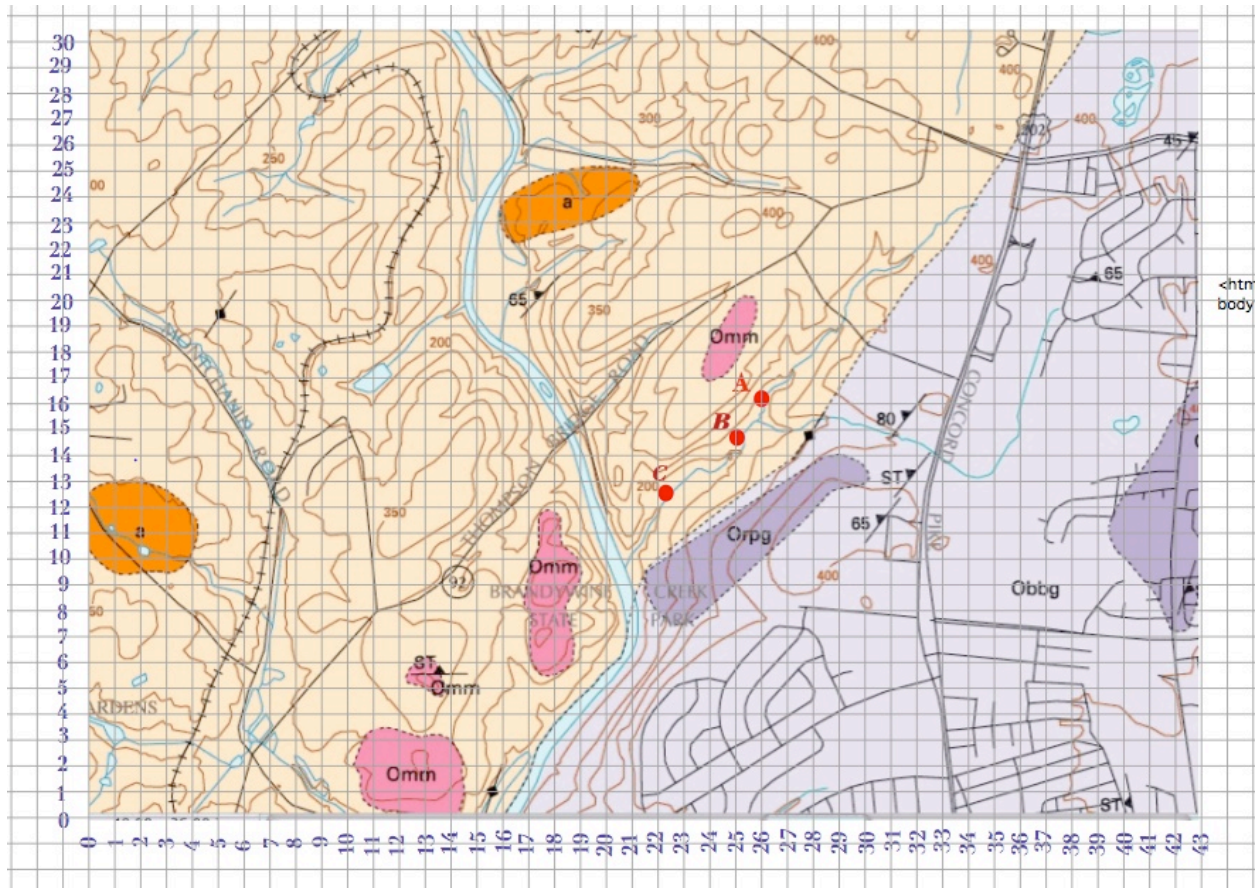
Velocity = distance / time

Slope or Gradient = Height 1 – Height 2 /Distance

Data:

Location 1 Slope or Gradient m/km

Trial	Time to go 5 m in seconds	Latitude	Longitude	Elevation
1	5.25	75.33.900 W	39.48.85 N	232.0 ft start
2	4.45			229.4 ft end
3	5.35			or
4	5.05			70.7136 m
5	4.60			69.9211 m



Location 2 Slope or Gradient m/km

Trial	To go 5 min seconds	Latitude	Longitude	Elevation
1	5.20	75.33.909 W	39.48.30 N	224 ft start
2	5.40			222.5 ft end
3	5.25			Or
4	4.35			68.2752 m
5	5.70			67.818 m

Location 3 Slope or Gradient m/km

Trial	Time (sec/m)	Latitude	Longitude	Elevation
1	4.95	75.37.929 W	39.48.76 N	217 ft start
2	5.80			215.2 end
3	5.50			Or
4	5.25			66.1416 m
5	5.30			65.5929 m

Analyze the data.

Calculate the velocity of the stream in meters per second.

Location 1	Location 2	Location 3

Calculate the slope for each location in meters per kilometer.

Location 1

Location 2

Location 3

Graph the velocity and slope data. Remember to label and title the graph. Include units. Use a different color for each trial.

Calculate the following:

Average Velocity for each location: Remember units.

Location 1:

Location 2:

Location 3:

Compare the slope/gradient to the average velocity. What observation can you make?

Was the hypothesis correct? Why or why not?

Activity Three

Identify the Trial locations on a topographic map of Brandywine Creek State Park. Latitude, longitude and elevation information can be found in the data table.

Activity Four

Examine the photographs of the stream valley. How do water velocity, streambed slope/gradient, and underlying rock type affect the shape of the stream valley? How might the stream valley change over time?

Predict what the stream valley might look like. Draw a cross section of the stream valley for each of the time frames.

10 years from now

50 years from now

100 years from now